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## GEOLOGY AND PALEONTOLOGY.

**Alleged Fossil Micrococci.**—M. B. Renault communicates to the Academy of Sciences (Paris) a note concerning certain Micrococci and Bacilli which he has found in Coal-Measures of Saint-Etienne and of Commentry. They occur in these formations in considerably larger quantities than they do in plants preserved in flint or in carbonate of lime. They are, moreover, less varied in form and dimensions than are those found in silicified plants, and they are not so much carbonized as the plants in which they are found. (*Revue Scient.*, Dec., 1896.) Any positive determination of such objects as are figured and described by M. Renault must, however, be regarded with suspicion, and some new light must be obtained on the process of fossilization before fossil Micrococci can be made credible.

**Geology of Luang Prabang.**<sup>1</sup>—The observations made by MM. Counillou and Massie during their stay at Luang Prabang, as members of the Pavie Mission, show the following facts:

(1) The existence in the vicinity of the region studied of *Productus* and *Schwagerina* limestones, which are the equivalent of the Moulmein (Birmaïne) beds, or one of the terms of the Salt Range series, and, perhaps, of the limestones of Sumatra.

(2) The presence, to the northwest of Luang Prabang, of a system of red clays, limestones and graywackes belonging to the Permian period, and exceedingly like the upper part of the Raingung group (India).

(3) The existence of a formation of purple clays and sandstones, beginning with a pudding-stone, and containing remains of *Dicynodonts*. Up to the present time these reptiles have been discovered only in the Karoo beds of South Africa, the Panchet of India and the Elgin of Scotland. It is natural then to consider this formation as constituting in Laos the base of the Trias.

(4) As to the limestone of Luang Prabang, although these two geologists believe its position to be inferior to the red clays, they cannot determine its exact age for want of sufficient stratigraphic and paleontologic data. (*Revue Scientif.*, Jan., 1897.)

**The Position of the Chico-Tejon Beds.**—Since the discovery of the Chico-Tejon series of marine beds on the Pacific coast by Conrad,

<sup>1</sup> Luang Prabang is situated on the left bank of the Mekong, in Cochinchina, 99° 45' long. E. and 19° 54' 20'' lat. N.

in 1855, there has been much debate over the determination of the age of the series. They were thought at one time to constitute transition beds between the Cretaceous and Eocene. After a critical study of the faunal relations of the series in question, Prof. T. W. Stanton arrives at the following conclusions :

"1. In all known sections that contain both Chico and Tejon the strata are apparently conformable. So far as it goes, this is an indication of continuous sedimentation ; but without further evidence it cannot be accepted as proof that there is no break, nor should it be given greater weight than the clear unconformability between Tejon and older Cretaceous beds in Oregon.

"2. The Martinez group of the California Survey is not a simple formation that can be considered a mere subdivision of the Chico, but consists of two distinct portions, one of which is Cretaceous and inseparable from the Chico, while the other is Eocene, and is here classed as Lower Tejon.

"3. The 'intermediate beds,' supposed by Gabb to form a transition from the Chico to the Tejon, are the same as the upper part of the Martinez group and the Lower Tejon. Their fauna, so far as known, includes no distinctively Mesozoic elements.

"4. The Chico fauna is characteristically Cretaceous, its so-called 'Tertiary types' being persistent or modern types that have changed but little from the Cretaceous to the present day.

"5. An examination of the species supposed to occur in both the Chico and the Tejon reduces their number to not more than six, and with one exception those are all persistent types that cannot be classed as Mesozoic. The exception is *Ammonites jugalis*, which Gabb collected from two localities supposed to be Tejon in the Mount Diablo region, but it has not been rediscovered in any subsequent Tejon collections. The Ammonoid seen by Heilprin in the Gabb collection from Fort Tejon may or may not be this species. It is held that the Tejon fauna is essentially Eocene and very distinct from the Chico, even though this ammonite should prove to belong to it.

"6. The time interval indicated by the decided change in faunas from the Chico to the Tejon cannot now be estimated. In fact, there is little evidence that the latter fauna is derived from the earlier, excepting in a few species ; and it is possible that all the changes took place by extinction and migration of species during the period in which the barren beds between the latest Chico and the earliest Tejon fossiliferous horizons were laid down. It will not be surprising, however, if evidence is sometime found of a period of erosion at the close of the Cretaceous

on the Pacific coast." (Seventeenth Ann. Rept. U. S. Geol. Surv., 1895-96, Pt. I, 1896.)

**The Position of the Periptychidæ.**—This family is one of the three which I placed in the Condylarthra on the establishment of that order, the two others being the Phenacodontidæ and the Menscotheriidæ. With regard to its phylogenetic position, I adopted the view that it is probably the type from which were derived the order Amblypoda. In a synopsis of the latter order, published in 1884,<sup>2</sup> I remark (p. 1129), "It was not until later (1877) that I assumed that the Diplarthra are descendants of the Amblypoda, although not of either of the known orders, but of a theoretical division with bunodont teeth. That such a group has existed is rendered extremely probable, in view of the existence of the bunodont Proboscidea and Condylarthra. This hypothetical suborder has been called Amblypoda Hyodonta." \* \* "The existence of Amblypoda Hyodonta is rendered almost certain by the discovery that the genus *Trigonolestes*<sup>3</sup> of the Wasatch epoch is an artiodactyle with tritubercular bunodont superior molars. The ancestral type of such a form must have been a tritubercular bunodont amblypod. *Pantolambda* is such a form with the tubercles modified into Vs. Moreover, such a type (Amblypoda Hyodonta) would be derived from a a Periptychid Taxeopod, with but little modification of the latter. A distinct facet of the astragalus for the cuboid bone, and probably a change of the carpus by an articulation of the unciform and lunar bones would be all that would be necessary. The discovery of *Pantolambda* has increased the probability of such a change having taken place in the hind foot, since the astragalus is intermediate in form between those of *Coryphodon* and *Periptychus*."

I have never concealed from myself the possibility that the Periptychidæ themselves might prove to be the Amblypoda Hyodonta. The astragalus has a considerable articulation with the cuboid bone, which has an obscure angular distinction from the facet for the navicular. So far as this articulation goes the family might be placed in the Amblypoda. I have awaited the discovery of the carpus of the Periptychidæ from that day to this (seventeen years); but success has not attended the efforts of Osborn and Wortman, who have searched for it. It is now, however, time to remark, that as there has been no other type discovered which could represent the Amblypoda Hyodonta, the probability that the Periptychidæ are that type, is increased. It is eminently

<sup>2</sup> AMERICAN NATURALIST, 1884, p. 1110.

<sup>3</sup> "*Pantolestes*" in the original=*Trigonolestes brachystomus*, which is not a *Pantolestes*.

probable that, since the alternation in the tarsus in that family is undoubted, it will also be found to exist in the carpus, as required for the missing type. Should this prove to be the case, the Periptychidæ must be removed from the order Condylarthra to the Amblypoda, where it will form the second family of the suborder Taligrada, the other family being the Pantolambdidæ. The two families will differ in this, that in the Periptychidæ the molars are bunodont, while in the Pantolambdidæ they are primitively selenodont, or with V-shaped cusps. This arrangement, if correct, puts the Periptychidæ in direct ancestral relationship to the Diplarthra, and so far confirms Schlosser's hypothesis that that family is the ancestor of the Artiodactyla. This view is also in accordance with that expressed by Osborn and Earle in their important paper on the Fossil Mammals of the Puerco: *Bull. Am. Mus. Nat. Hist.* New York, 1895, p. 47.

The families of the Condylarthra will be, in that case, the Phenacodontidæ and the Menseotheriidæ, and the Pleuraspitheriidæ of Lemoine, if the last be different as a family from both of the others. —E. D. COPE.

**Glacial Beaches of Michigan.**—During the past year Mr. F. B. Taylor has made a study of the moraines, abandoned beaches and outlets of the glacial lakes which formerly occupied the southern part of the lower peninsula of Michigan. His conclusions are as follows:

The glacial waters that gathered in the Erie, Huron and Ontario basins during the retreat of the ice-sheet underwent many changes. In falling from their highest level to the present level of Lake Erie the

Stages.	Lakes.	Beaches.	Outlets.	Moraines.
1	Maumee.....	Van Wert.....	Fort Wayne.....	Defiance.
2	Unnamed.....	Leipsic.....	Imlay.....	Toledo and Detroit.
3	Whittlesay.....	Belmore.....	Tyre Uby.....	Port Huron, Saginaw.
4	Unnamed.....	Arkona.....	Undecided.....	Undecided.
5	Warren.....	Forest.....	Pewamo.....	Undecided.

(*Bull. Geol. Soc. Amer.*, Vol. 8, 1897).

glacial waters changed the place of their outlet four or five times. At each change they paused for a time, sufficient to make a distinct beach. For the whole series of lakes the author would propose a descriptive,

general name, as the Erie-Huron lakes, and for each separate stage having a separate outlet a particular name. Mr. Taylor's especial contribution to science in this paper is the discovery of certain outlets and the correlation of the shore-lines (as shown by the beaches), the outlets, and the retaining dams (indicated by the moraines) of the separate lakes. The relations of these features to each other are discussed in detail, but may be indicated by the table on page 336.

**Lake Agassiz.**—Mr. J. B. Tyrrell suggests that Lake Agassiz had its beginning as follows: Starting with the Dawson idea of three great centers of snow and ice on the North American continent during the glacial period, he traces the history of the centre great glacier (Kewatin) which originated northwest of Hudson Bay. A portion of this glacier occupied the basin of Lake Winnipeg and the Red River Valley for a long time. As it retired a portion of the eastern or Laurentide glacier was advancing. The Kewatin glacier seems to have retired northward well into Manitoba, and possibly even beyond the northern limit of that province, before it was joined by the eastern glacier. When they united the water was ponded between the fronts of the two glaciers to the north and east, and the high land to the south and west. Such is the origin of Lake Agassiz. Its waters rapidly rose until they overflowed southward into the valley of the Mississippi, and then gradually declined as the river Warren deepened its channel. (Journ. Geol., Vol. IV, 1896).

**The Prehistoric Dog.**—M. Th. Studer, of Berne, has presented an interesting work to the *Soc. helvétique des sci. nat.* on the races of dogs found in the lacustrine deposits of the Stone Age. These are *Canis palustris*, a small species dating from the neolithic; a large dog found in Lake Ladoga and Lake Neuchatel, which is related to the Siberian sledge-dog; and *Canis familiaris Leineri*, a large, slender dog, reminding one of the Scottish greyhound.

The shepherd dog appeared in the Age of Bronze, and also a hunting dog (*Canis familiaris matrix-optimæ* and *Canis fam. intermedius*). These different races have a common palearctic origin. The Mediterranean and Egyptian races are derived from a different type of equatorial origin. (Revue Scientif., Jan., 1897).

**Geological News.**—**MESOZOIC.**—The Museum of Lyon publishes in its Archives the drawings made by M. Jourdan, of a series of singular organisms which he classed as Echinoderms under the names *Pegmaerinus cupulatus*, *P. radiatus*, *P. inflatus* and *P. gracilis*. Since Mr. Jourdan's death these organisms have been much in dispute; zoologists

refuse them a place among Echinoderms, and botanists deny their being calcareous algæ. On the same plate are figured two fine Echinoderms from Cirin. They are described by M. P. de Loriol. (Arch. Mus. d'hist. nat., Lyon, T. 16, 1895).

A new fossil fish reported by Mr. R. Storms from the bruxellien sandstone is remarkable for its size. It is referred to the genus *Cybium* with the specific name *proostii*. Its mandible measures 34 centimeters. If its proportions correspond with the modern *C. regale*, its total length must have been not less than 2.55 m., or double that of *C. bleekerii*, found in the same formation. (Bull. Soc. Belge de Geol., T. IX, [1895] 1897).

CENOZOIC.—Nine new species and varieties of Ostracoda from the Pliocene beds near Berkeley, California, are described and figured by Mr. Frederick Chapman. The specimens are such as inhabit fresh water at the present day, with the exception of one, a *Cypripopsis*, which is as often found in brackish water. They are all comprised in the family of the Cypridæ. It is suggested by Dr. Merriam that the Ostracoda may be of use in determining horizons of the Berkeley Pliocene beds. (Bull. Dept. Geol., Univ. Calif., Vol. 2, 1896).

An interesting bone breccia was discovered some months ago in the neighborhood of the Wombeyan caves, New South Wales, by Mr. R. Broom. The deposit is old, and contains a few new forms, 5 of which are described in the Proceeds. Linn. Soc., N. S. W. According to the author this 1895-96 collection from this deposit gives a fair idea of the smaller animals living in later Tertiary times. One of the important discoveries was that of *Dromicia nana*, represented by a number of both lower and upper jaws. This find establishes Thomas' theory that *Dromicia* existed formerly in Eastern Australia. Mr. Broom considers it probable *D. nana* still survives in the district of the Wombeyan caves. (Proceeds. Linn. Soc., N. S. W., 1896).

The fossil bones of several species of monkeys found in the caves of Brazil by Lund have been recently described by M. H. Winge. With one exception the species are still existing, and are found in the same localities to-day. The one extinct species, to which M. Winge gives the name *Eriodes protopithecus*, is represented by several detached bones, which cannot be referred to one individual, but which, without doubt, can be referred to the same species. The new form resembles *E. arachnoides*, having the same long, slender limbs, but shorter fingers, and the measurements show that it must have been a very much larger animal than its living relative. (E. Museo Lundii, Kjobenhavn, 1895-96).